FOOD CONTACT CENTER
Laboratorio Accreditato EN ISO/IEC 17025 da Accredia
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F.A.O.

JARSTY S.R.L.

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Pistoia, 27/06/2022

Object: Comparative study between JARSTY container and different containers purchased on the market for the evaluation of the shelf life of food produced according to recipes provided by the customer, cooked in the JARSTY container and stored in the same container and in a different container purchased on the market.

INTRODUCTION AND DESIGN OF TEST PLAN:

The customer intends to place on the market the JARSTY container which, through a specific cooking process, has the ability to reduce the microbial load and enzymatic oxidations in the food, giving a shelf-life at a refrigeration temperature of about 15 days.

WHAT IS SHELF LIFE?

By definition shelf life is the time interval, after production and packaging, during which the food, stored under specific conditions, maintains an acceptable level of quality.

Acceptability depends on many factors:

- Microbial proliferation
- Variation of color/smell/taste;
- Oxidative phenomena and loss of vitamins or nutrients
- Development of undesirable sensory characteristics and loss of the initial aromatic imprint

The shelf life depends first of all on the recipe of the product, the chemical-physical properties and the initial microbiological profile. Packaging, packaging and storage conditions are fundamental.

The raw material is therefore the first factor to consider in a shelf life study and its quality will depend on that of the finished product. In this sense, it is important to assess the need for additives that increase conservation, including by changing the pH.

But in addition to the characteristics of the food, other factors are fundamental such as:

- the cooking/transformation process of the food
- the type (thickness and barrier properties) of the packaging and the packaging process used. Sometimes it is also useful to use active and intelligent packaging
- environmental variables and therefore conservation Conditions

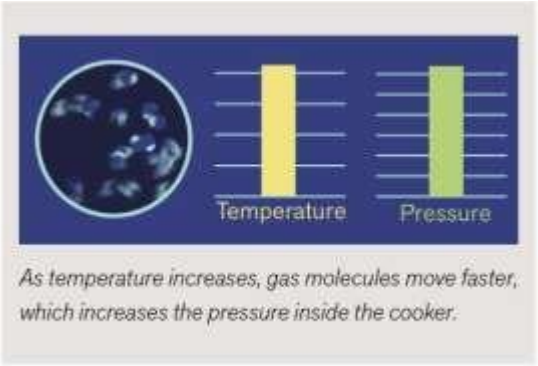
Schematizing:

It is therefore important to be aware that packaging is only one of the variables involved in the definition of shelf life.

The peculiarity of the process patented by the customer lies in the fact that the food is cooked partly under pressure (despite the valve of JARSTY is open during cooking) and, as a result of the temperature reduction and the closure of the valve, also under vacuum.

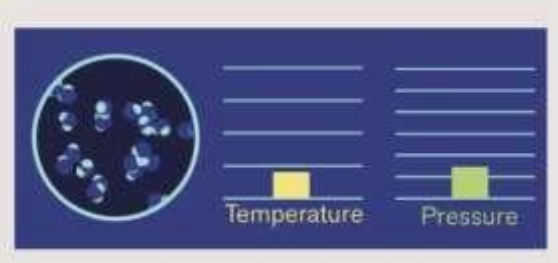
When cooking in a normal container at atmospheric pressure, the water boils at 100°C. Inside a pressure vessel,

the pressure can increase to almost 2000 millibars. **At that pressure, the water boils at 121°C. This means that food can cook at a much higher temperature than it could ever at atmospheric pressure, and since cooking reactions accelerate to higher temperatures, food cooks faster. It also does not dry out, as the water remains in liquid form.**



As temperature increases, gas molecules move faster, which increases the pressure inside the cooker.

During microwave cooking, as soon as the heating phase due to the action of the microwave oven ceases, a vacuum condition begins to be created in the container. In fact, the decrease in temperature corresponds to a reduction in pressure.



When the vacuum inside a container is created, the amount of atmospheric gases (oxygen, nitrogen, etc.) present in it decreases; this operation of alteration of the total pressure inside the container itself produces important consequences (mostly positive) on the characteristics of the food that you need to know well to understand the effects of vacuum application.

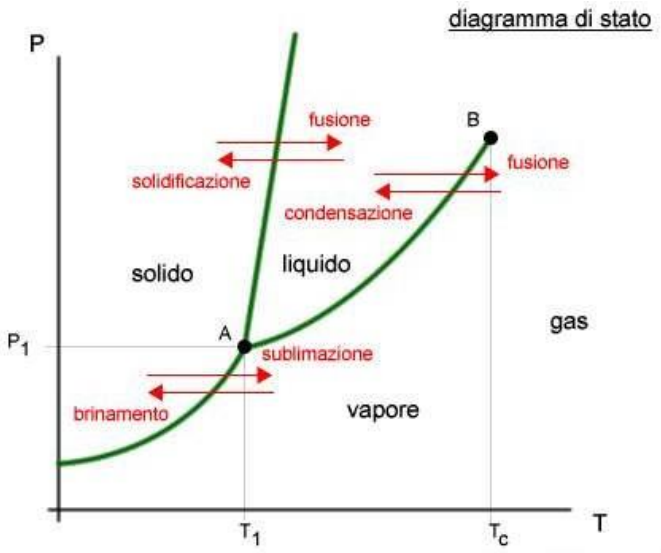
The pressure of gases is expressed with different units of measurement (atmospheres, bar, pascal, torr etc.), but the most common is the millibar (mbar, the thousandth part of a bar) and the pressure of our atmosphere is worth (at sea level) 1013.3 mbar. The atmosphere consists of about 21% oxygen and 79% nitrogen (other gases and water vapor are also present in the air to a much lesser extent), so the total pressure (1013 mbar) is to be divided into these proportions. between the two gases: that is to say that oxygen "weighs" for 212.73 mbar (21% of 1013) and nitrogen for 800.27 mbar.

For example, making a vacuum of 99.5% in a food container, the total pressure of the atmosphere inside it is reduced to 5.06 mbar (0.5% of 1013) and therefore oxygen will weigh only 1.06 mbar (21% of 5.06). This considerable reduction in oxygen pressure corresponds to an equivalent reduction in the available volume of this gas, therefore

to a lower possibility for aerobic microorganisms to use it to survive and multiply and to a lower speed of all those chemical and enzymatic reactions (for example oxidation and rancidity) that occur in the presence of oxygen.

In all foods there is water that has been added during preparation or represents a constituent of the ingredients. It is, of course, in a liquid state because the water at a temperature greater than 0 ° C, at a pressure of 1013.3 mbar, at sea level, is in a liquid state. If we start to increase the temperature we start its evaporation that will become gradually faster as we approach the temperature of 100 ° C, at which the water will boil and the evaporation process will have its maximum speed. If we decrease the pressure, we automatically obtain a decrease in the temperature threshold to which the boiling of water corresponds (100 ° C). Indeed in mountain, at an altitude of 2100 m, corresponding to an atmospheric pressure of 701.3 mbar, water boils at 90°C, and at 6000 m, at a pressure of 473.3 mbar, water boils at 80°C.

These aspects are represented graphically in the water state diagram:



By lowering the pressure value, the water boils (changes to the vapor state) at a temperature below 100°C. Similarly, other phenomena, connected with the cooking mechanism, can occur at lower temperatures and, therefore, without altering or modifying the more thermolabile components (more sensitive to heat). In addition, pressure reduction is achieved by extracting the air and then removing oxygen which, especially at high temperature, can give rise to oxidation or denaturation reactions of numerous food constituents.
As soon as the microwave heating is finished, a vacuum begins to be created in the container and the cooking is then finished in vacuum conditions.

This terminal phase of vacuum-packed cooking allows to maintain unchanged many useful components both from a nutritional point of view (vitamins, proteins, carbohydrates and fats) and from an organoleptic point of view (savory or fragrant substances). In particular, the organoleptic variations that can occur during traditional cooking and with

the use of high temperatures mainly concern the color, aroma, taste, weight and digestibility of the food product which, with a vacuum treatment, are safeguarded much better.

With the absence of oxygen, benefits are obtained on organoleptic qualities and an increase in shelf-life in practically all foods, in particular in refrigerated perishable foods, in products containing fats easily subject to lipid oxidation and in those susceptible to mold growth.

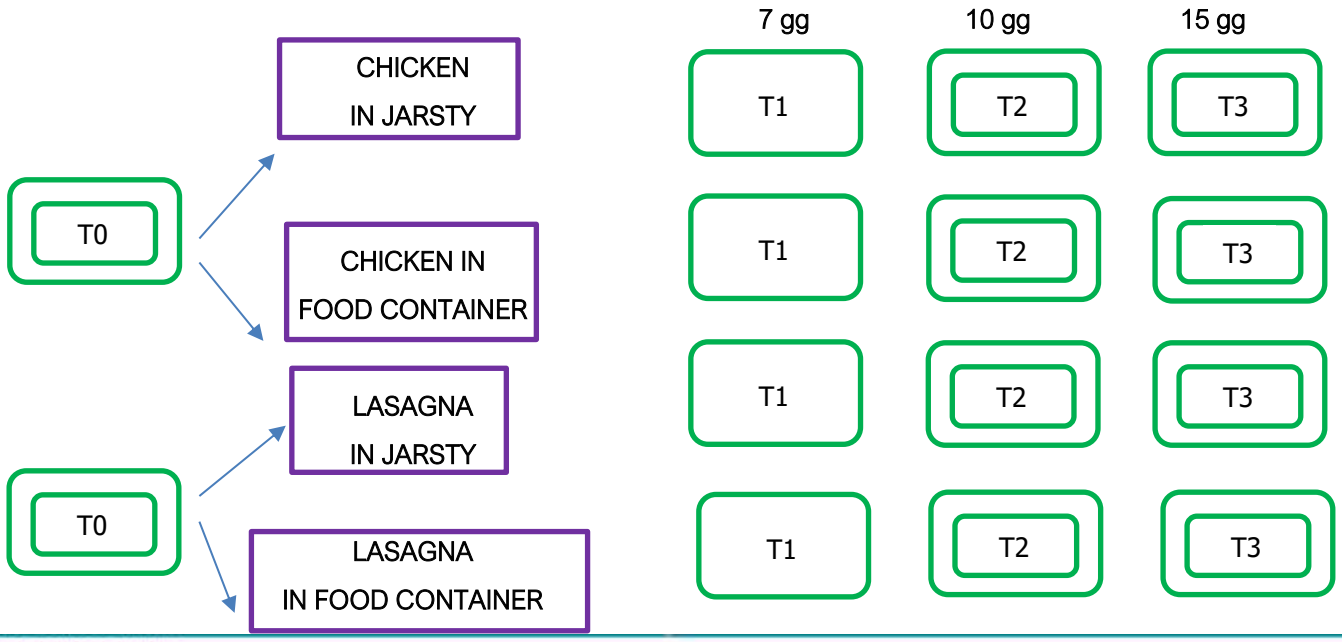
Vacuum packaging, which takes place during the storage phase in the refrigerator, is not suitable for extremely fragile, soft products or products that would be ruined by the pressures produced by this packaging system. It should not be forgotten that several altering and pathogenic microorganisms are still able to develop in the absence or scarce presence of oxygen (eg Clostridium botulinum, Listeria monocytogenes, Staphylococcus aureus ...), therefore this packaging system, as well as the packaging in modified atmosphere, cannot compensate for poor quality or microbiological starting characteristics, which must always be guaranteed by good processing practices. It must also be said that oxygen-free storage environments, such as vacuum or modified atmosphere packaging, favor the development of lactic acid bacteria compared to other aerobic microbial species.

Despite their preservative action at high levels (>107 cfu/g), they can produce organoleptic alterations in some types of food.

TESTS DESIGN AND OBSERVED PERFORMANCES

The study planned to compare the shelf life of products that have undergone the cooking/ pasteurization/storage treatment in the JARSTY container, and of the products that have also undergone cooking/pasteurization in the JARSTY container but stored in different products purchased on the market.

The durability of the food was verified at T = 0, after preparation and storage at 7 days, 10 days, and after 15 days.



For the samples that were subjected to analysis (samples circled in green in the image) partial and total test plans were foreseen. For samples with double circle, the complete plan was foreseen, for samples with single circle only the sensory evaluation and the microbiological package were foreseen.

The following evaluations were carried out on the lemon chicken samples, at T=0, T=1, T=2 and T=3 (for T1, T2, T3 also on the non-JASTY plastic container):

- Count of microorganisms at 30°C
- Count of Yeast
- Count of Molds
- Count of Coliform bacteria
- Sensory evaluation and GC MS screening
- pH.

The following evaluations were carried out on the lasagna samples, at T=0, T=1, T=2 and T =3 (for T1, T2, T3 also on the container in different purchased on the non-JASTTY market):

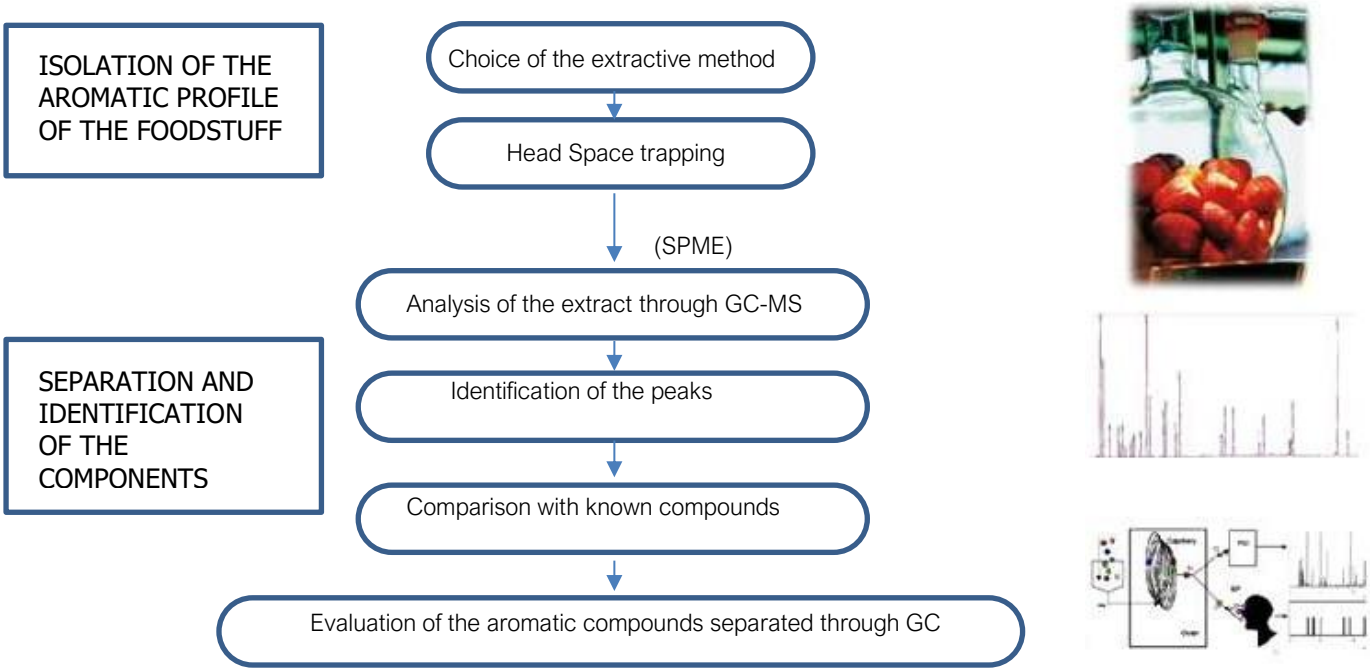
- Count of microorganisms at 30°C
- Count of Yeast
- Count of Molds
- Count of Mesophilic lactic acid bacteria
- Sensory evaluation and GC MS screening
- pH

The samples to be tested were therefore:

- T0 = 2 samples cooked in the microwave in JARSTY container (lemon chicken and lasagna);
- T1 after 7 days = 2 samples stored in JARSTY container and 2 samples stored in different food container purchased on the market;
- T2 after 10 days = 2 samples stored in JARSTY container and 2 samples stored in different food container purchased on the market;
- T3 after 15 days = 2 samples stored in JARSTY container and 2 samples stored in different food container purchased on the market.

After the microwave treatment (duration and power suggested by the customer), the temperature of the samples was measured with a temperature probe directly in the heart of the dish. This was in order to assess whether you the food was pasteurizing or sterilizing.

SPME-GC/MS instrumental analysis of the aromatic profile



The analysis of the volatile substances constituting the aroma is carried out through laboratory methods that include a sampling phase and concentration of aromatic substances and a phase of analysis of the chemical nature as well as of their concentrations using high precision analytical instruments.

The sampling and concentration of volatile aromatic substances present in the "headspace" (volatile component emitted by an agri-food product and present in the surrounding atmosphere) is an innovative and widely used technique for flavor sampling and it is called SPME (solid phase microextraction) in which the adsorbent phase consists of a fused silica fiber.

Subsequently, thermal desorption is carried out inside a gas chromatographic injector or by the use of solvent.

Gas chromatography combined with mass spectrometry (GC-MS) is a very powerful technique that allows accurate analysis of the chemical composition of a given sample allowing the identification and quantification of most of the chemical species present.

The difficulty in performing the analysis of the aromatic profile, carried out by very few laboratories, is the correct recognition of the molecules. Food Contact Center employs technicians with plenty years of experience in the investigation of food aroma in GC MS, thanks also to the consolidated collaboration with the group of Prof. Fernando Tateo, former Full Professor of Food Science and Technology at the University of Milan, specialized in Chemistry and Technology of Flavors and Fragrances; moreover, the laboratory has long invested in this area by acquiring the Library specialized in Flavor and Fragrance- The FFNSC GC/MS Library Ver.1.3 specialized for 1,830 flavor and fragrance compounds that contains mass spectra as well as retention indices, produced by the Group of Prof.

Mondello – University of Messina- Italy.

The purpose of the SPME-GC/MS instrumental analysis is to verify the behavior of substances with aromatic function, appropriately selected according to the food, in the shelf-life process.

In the present study, the laboratory has identified and traced where necessary the decay of typical flavors of the food and characterized the formation of off-flavors due to degradation.

SAMPLE PREPARATION:

Lasagne Bolognese style

INGREDIENTS:
150 g Bolognese sauce
100 ml béchamel sauce
2 sheets lasagna dough (fresh pastry)
3 tablespoons Parmesan cheese

- Mixed the sauce with béchamel sauce; add two tablespoons of grated cheese and stir again.
- Cut the lasagna into several square pieces so that they can comfortably fit into the container.
- Grease with very little oil the bottom of a JARSTY.
- Add 2 tablespoons of meat sauce and béchamel sauce.
- inserted a piece of lasagna.
- Add 2 tablespoons of meat sauce and béchamel sauce

- Continued with alternative layers of pasta and meat sauce and béchamel sauce to create 4 layers.
- Completed the preparation with a sprinkling of grated cheese.
- Hooked the lid and opened the valve of JARSTY.
- Microwaved for 6 minutes at about 800W with valve open.
- Extracted JARSTY from the microwave, closed the valve and let the lasagna rest for 30 minutes at room temperature.

Chicken with lemon, thyme and capers

INGREDIENTS:

250 gr chicken breast.

1/4 lemon, sliced.

1 garlic clove.

1/2 tablespoon salted capers.

1 tablespoon extra-virgin olive oil

1 teaspoon thyme

Salt

Pepper

- Cut the lemon into facts.
- Cut the chicken into chunks (each piece corresponds to a bite).
- Transfer all ingredients to a bowl.

- It is seasoned with the clove of garlic, oil, salt and pepper.
- Mix well and put the mixture in JARSTY.
- Hooked the cover and open the valve.
- Cooked in the microwave for 5 minutes at about
- Extract JARSTY from the microwave, close th temperature.

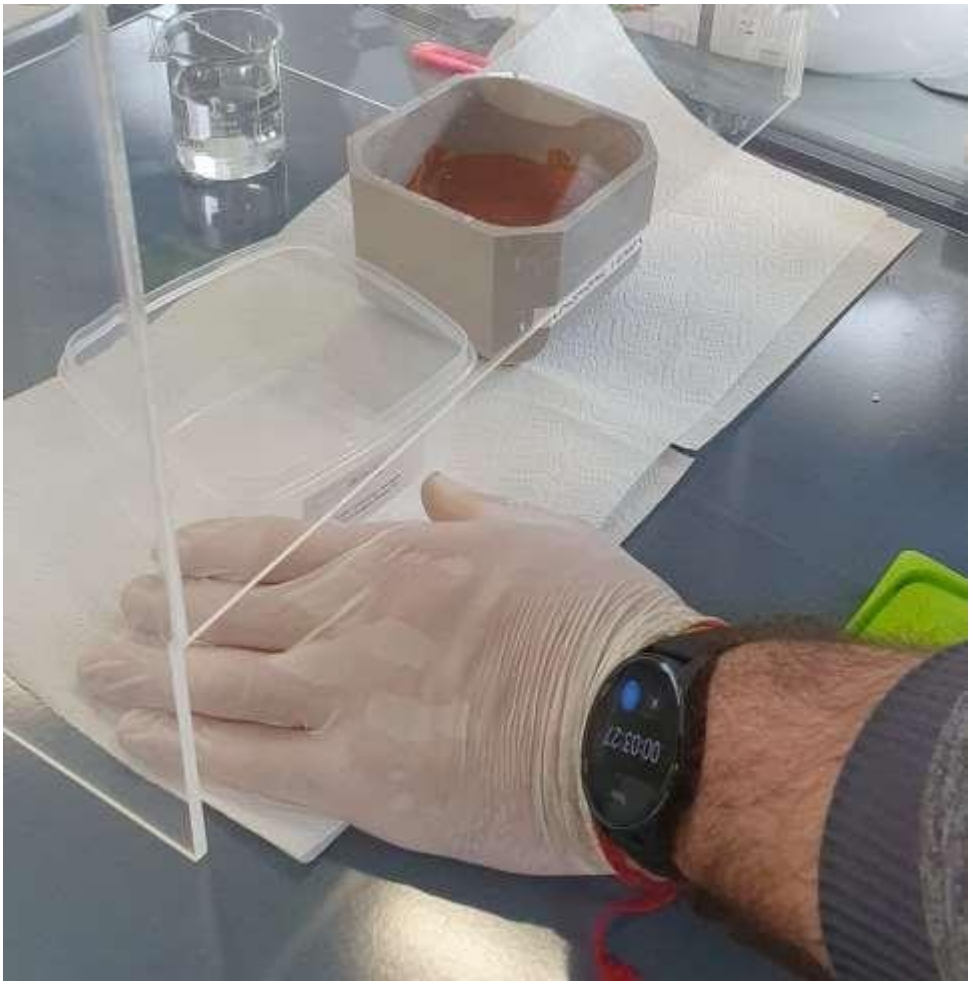
CHECK OF THE MICROWAVE POWER

As indicated by the Customer, the microwave power taken as a reference for the development of recipes, was verified with this procedure:

- Insert 450g of mains water in JARSTY
- Close the lid and open the valve
- Heat up in the microwave for exactly 3 minutes and measure the temperature of the external wall with infrared thermometer (agreed with the customer an acceptability range between 45 °C and 55 °C)
- Record the temperature (as shown in the photo below) of 53.3 °C

ANALYSIS CARRIED OUT AND RESULTS

After the preparation of the dishes, the laboratory proceeded with the conservation; the food, all cooked in JARSTY according to the customer's instructions, were then divided for the comparative study of shelf life: half were transferred to different canners purchased on the market while the other half left in JARSTY with closed valve.



Test Performed-Summary of results-Chicken with lemon, thyme and capers.

JARSTY container - Chicken with lemon, thyme and capers				
Organoleptic analysis	T0	T1 (7 days)	T2 (10 days)	T3 (15 days)
Acceptability (%)	100	100	85	85
Accepted (Si/No)	Si	Si	Si	Si
SPME-GC/MS instrumental analysis	No reports	No reports	No reports	Slight loss of aroma and individuation of off-odors, but acceptable
pH	5,39	5,50	5,71	5,79
Microbiological analysis				
Count of Coliform bacteria (CFU/g)	<10	<10	<10	<10
Count of microorganisms at 30°C (CFU/g)	$2,7x10^3$	<10	$5,1x10^2$	$1,1x10^2$
Count of Yeast (CFU/g)	<10	<10	<10	<10
Count of Molds (CFU/g)	<10	<10	<10	<10
Count of anaerobic sulfite reducers bacteria (CFU/g)	<10	<10	<10	<10
SENSORY EVALUATION	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

Common Container - Chicken with lemon, thyme and capers				
Organoleptic analysis	T0	T1 (7 days)	T2 (10 days)	T3 (15 days)
Acceptability (%)	100	85	70	65
Accepted (Yes/No)	Si	Si	Si	Si
SPME-GC/MS instrumental analysis	No reports	No reports	No reports	Slight loss of aroma and individuation of off-odors.
pH	5,41	5,59	5,73	6,05
Microbiological analysis				
Count of Coliform bacteria (CFU/g)	<10	<10	<10	<10
Count of microorganisms at 30°C (CFU/g)	$2,7x10^3$	<10	$1,0x10^3$	$1,0x10^2$
Count of Yeast (CFU/g)	<10	<10	<10	<10
Count of Molds (CFU/g)	<10	<10	<10	<10
Count of anaerobic sulfite reducers bacteria (CFU/g)	<10	<10	<10	<10
SENSORY EVALUATION	ACCEPTABLE	ACCEPTABLE	Loss of consistency and state of preservation.	Loss of smell, taste, consistency and state of conservation.

Details

SPME-GC/MS instrumental analysis of the aromatic profile

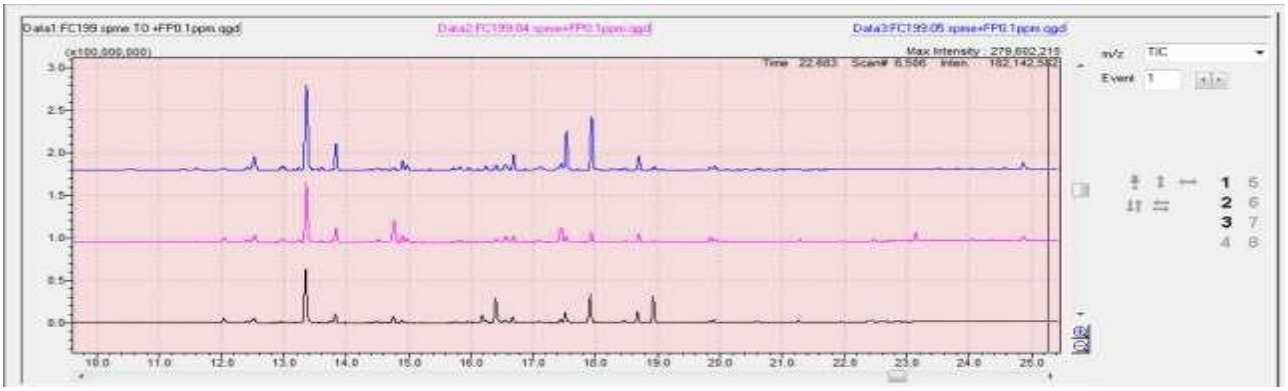
Chicken

Comparison and evaluation JARSTY - Common container for food storage

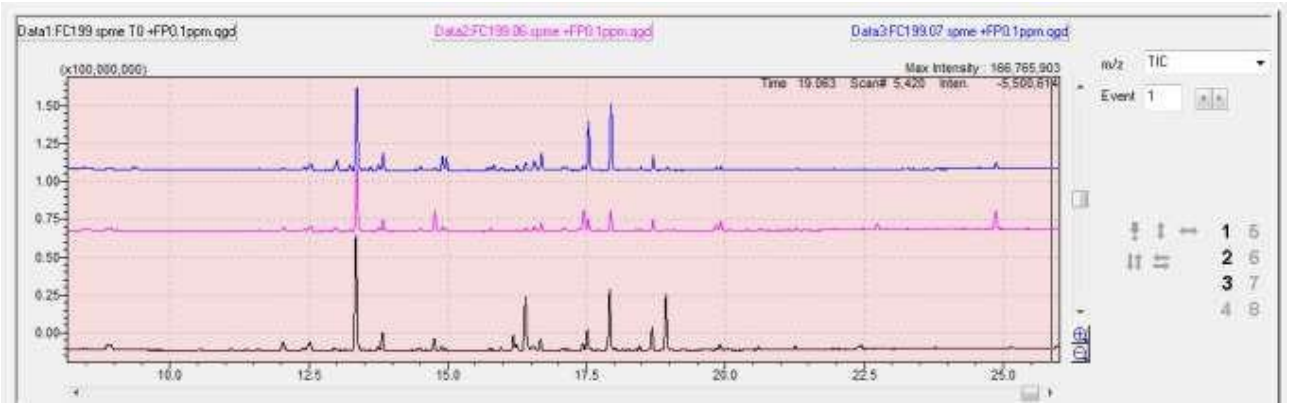
- FC220199.01 Chicken Time T0
- FC220199.04 Chicken Time T2 (10 days) – JARSTY Container
- FC220199.05 Chicken Time T2 (10 days) - Common container for food storage
- FC220199.06 Chicken Time T3 (15 days) - JARSTY Container
- FC220199.07 Chicken Time T3 (15 days) - Common container for food storage

Screening in SPME GC/MS – 10 days: overlapped chromatograms:

1. T0 (black)
2. Chicken Time T2 (10 days) - JARSTY (pink) Container
3. Chicken Time T2 (10 days) - Common container for food storage (blue)



Screening in SPME GC/MS: overlapped chromatogram to T0 (black) with chromatogram Chicken Time T3 (15 days) - JARSTY (pink) and chromatogram Chicken Time T3 (15 days) - Common container for food storage (blue)



COMMENTS

The evaluation of the odorous organic components typical of chicken gave similar values, but focusing on the profile of oxidized products (aldehydes and ketones) it is clear that the chicken stored in the common container developed more aldehydes due to degradation.

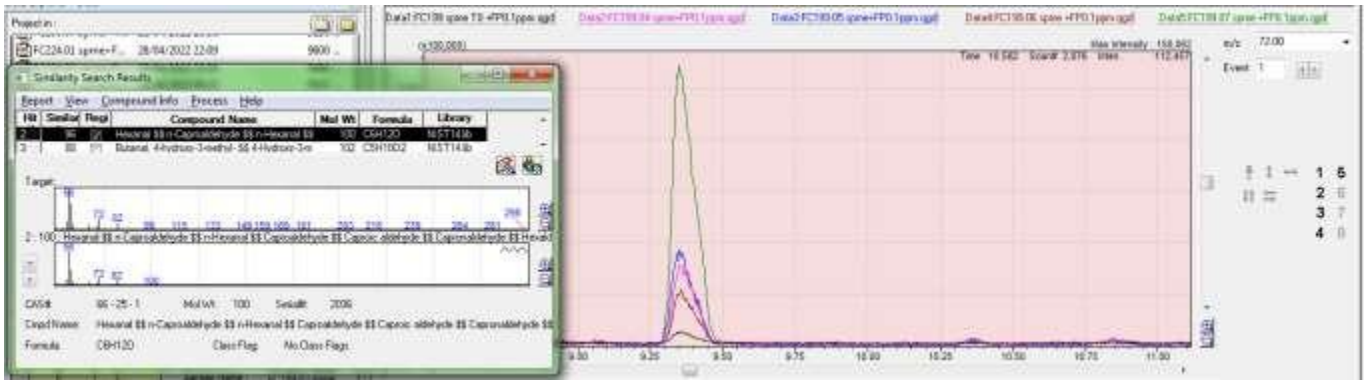
In fact, from the overlapping of the chromatograms, it is clear that the traces related to the JARSTY container chicken have a much smaller quantity of oxidized products than the traces related to the chicken stored in the common container.

This emerges by evaluating particular peaks, as described below.

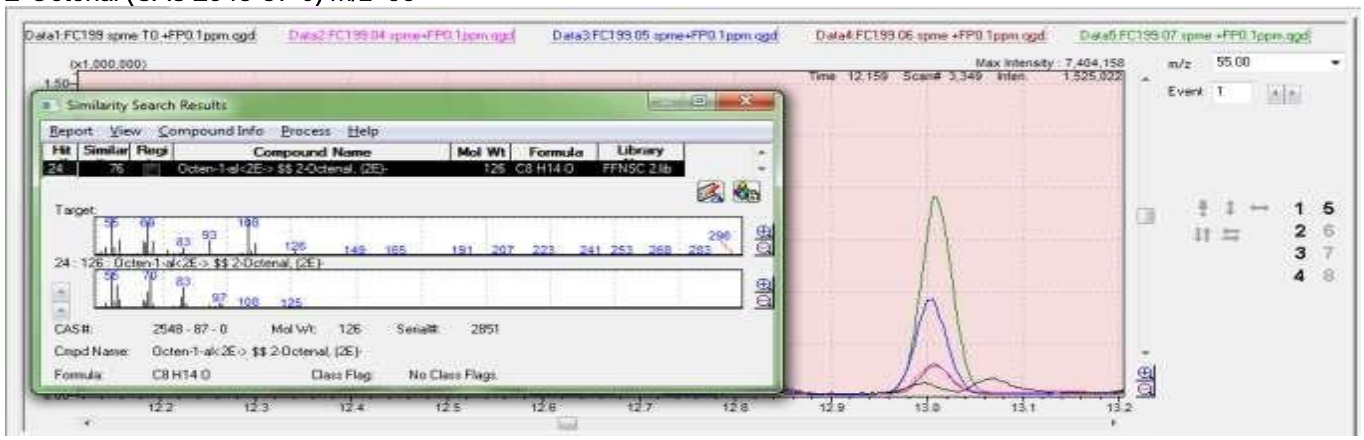
Detail of Screening in SPME GC/MS: overlapped chromatograms:

1. T0 (black)
2. Chicken Time T2 (10 days) - JARSTY (pink),
3. Chicken Time T2 (10 days) - Common container for food storage (blue)
4. Chicken Time T3 (15 days) - Container model JARSTY (amaranth)
5. Chicken Time T3 (15 days) - Container Common for food storage (green).

Capronaldehyde (CAS 66-25-1) m/z=72



2-Octenal (CAS 2548-87-0) m/z=55



So, the production of off flavors is higher for chicken stored in the common container for food storage.

Flavour decay

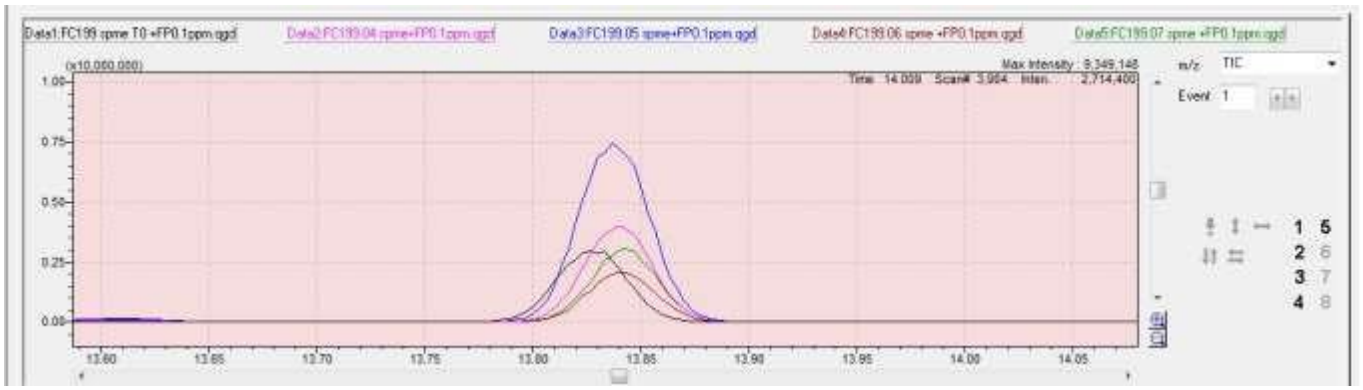
The evaluation of the odorous organic components typical of the chicken recipe instead clarifies that the aromatic profile is slightly better in the products stored in the JARSTY container

The plots for chicken cooked and stored in the JARSTY container have slightly higher concentrations of the typical terpene components of chicken ingredients than the traces for chicken stored in the traditional container.

Pinene <beta-> (CAS 127-91-3)

Limonene (CAS 138-86-3)

Terpinene <gamma-> (CAS 99-85-4)



The evaluation of the aromatic profile was combined with a study of the related scientific literature, reported at the end of the report.

Test Performed-Summary of Results- Lasagna

Container JARSTY - Lasagna				
Organoleptic analysis	T0	T1 (7 days)	T2 (10 days)	T3 (15 days)
Acceptability (%)	100	85	85	80
Accepted (Yes/No)	Yes	Yes	Yes	Yes
SPME-GC/MS instrumental analysis	No reports	No reports	No reports	Slight loss of aroma and individuation of off-odors, but acceptable
pH	5,41	5,45	5,51	5,55
Microbiological analysis				
Count of Mesophilic Lactic acid bacteria (CFU/g)	<10	<10	<10	<10
Count of microorganisms at 30°C (CFU/g)	<10	<10	$1,0x10^2$	$4,0x10^1$
Count of Yeast (CFU/g)	<10	<10	<10	<10
Count of Molds (CFU/g)	<40	<10	<10	<10
Count of anaerobic sulfite reducers bacteria (CFU/g)	<10	<10	<10	<10
EVALUATION SENSORY	ACCEPTABLE	ACCETTABILE slight acidulous note	ACCEPTABLE	ACCEPTABLE

Common Container - Lasagna				
Organoleptic analysis	T0	T1 (7 days)	T2 (10 days)	T3 (15 days)
Acceptability (%)	100	100	70	65
Accepted (Yes/No)	Yesi	Yes	Yes	Yes
SPME-GC/MS instrumental analysis	No reports	No reports	No reports	Slight loss of aroma and individuation of off-odors
pH	5,40	5,53	5,72	5,83
Microbiological analysis				
Count of Mesophilic Lactic acid bacteria (CFU/g)	<10	<10	<10	<10
Count of microorganisms at 30°C (CFU/g)	<10	<10	$2,1x10^2$	$5,0x10^1$
Count of Yeast (CFU/g)	<10	<10	<10	<10
Count of Molds (CFU/g)	<40	<10	<10	<10
Count of anaerobic sulfite reducers bacteria (CFU/g)	<10	<10	<10	<10
SENSORY EVALUATION	ACCEPTABLE	ACCEPTABLE	Moisture loss consistency.	Loss of smell, taste, consistency and worst state of preservation.

Details

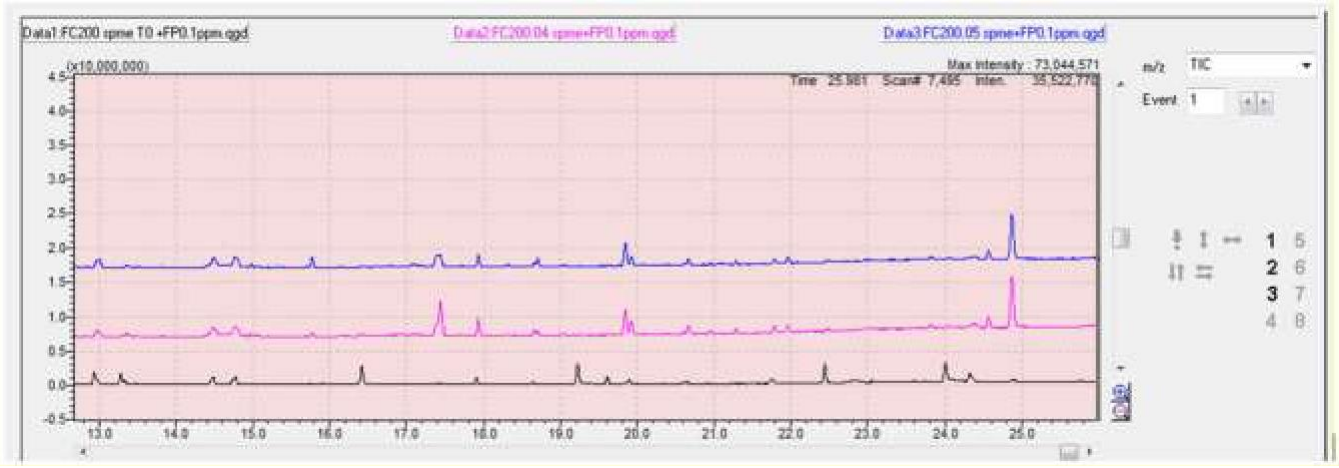
SPME-GC/MS instrumental analysis of the aromatic profile

Comparison and evaluation JARSTY - Common container for food storage

- FC220200.01 Lasagna Time T0
- FC220200.04 Lasagna Time T2 - JARSTY Container
- FC220200.05 Lasagna Time T2 - Common container for food storage
- FC220200.06 Lasagna Time T3 - JARSTY Container
- FC220200.07 Lasagna Time T3 - Common container for food storage

Screening in SPME GC/MS: overlapped chromatogram:

1. T0 (black)
2. Lasagna Time T2 (10 days) - Container model JARSTY (pink)
3. Lasagna Time T2 (10 days) - Common container for food storage (blue)

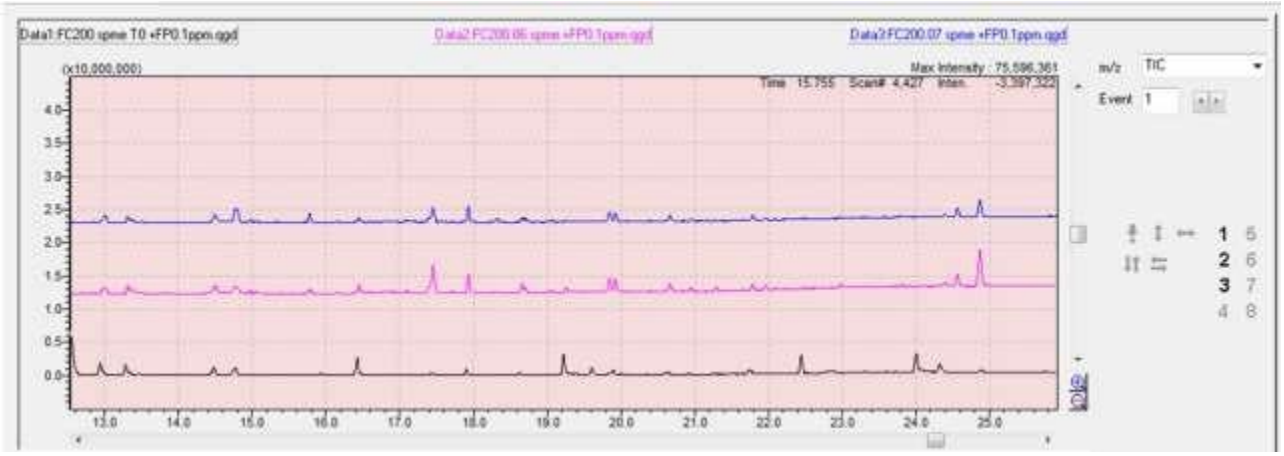


Screening in SPME GC/MS: overlapped chromatogram:

T0 (black)

Lasagna Time T3 (15 days) - Container model JARSTY (pink)

Lasagna Time T3 (15 days) - Common container for food storage (blue)



COMMENTS

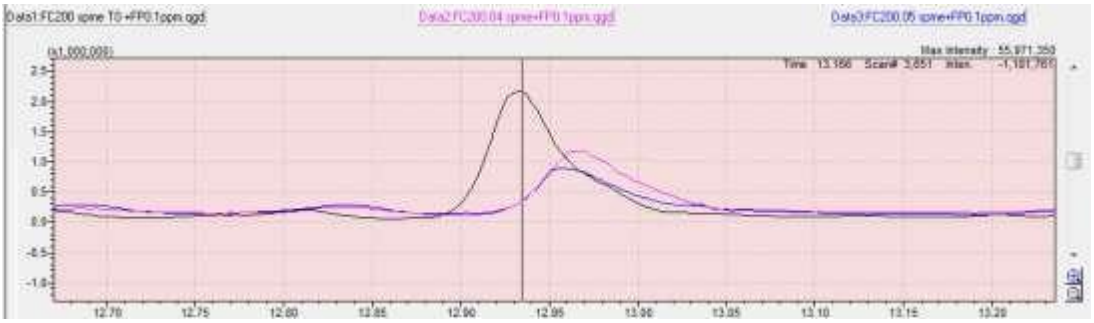
The evaluation of the odorous organic components typical of lasagna gave similar values, but focusing on the profile of oxidized products (aldehydes and ketones) it is clear that the lasagna stored in the common container developed more aldehydes due to degradation.

Flavour decay

The evaluation of the odorous organic components typical of lasagna ingredients makes it clear that the flavor profile is slightly better in the products stored in the JARSTY container

In fact, from the overlapping of the chromatograms emerges a concentration of terpenes, with the same storage period, in the lasagna contained in the JARSTY they are slightly higher:

Benzaldehyde (CAS 100-52-7)



Furthermore, from the overlapping of the chromatograms, it emerges that the paths relating to the JARSTY container lasagna have a lower quantity of oxidized products than the traces relating to the lasagna stored in the common container:

Heptyl methyl ketone cas 821-55-6

The evaluation of the aromatic profile was combined with a study of the related scientific literature, reported at the end of the report.

Sensory analysis

The sensory evaluation was performed through acceptability tests with panels of 3 trained tasters.

The test involves the evaluation of the product through a judgment of acceptability for each individual attribute considered: appearance, color, smell, taste, texture. All attributes have the same weight. When at least 60% of tasters express the judgment of “NOT ACCEPTED", the product is considered no longer acceptable from a sensory point of view. We must point out that this percentage has been chosen in an absolutely arbitrary manner. The Customer can independently decide whether to make the acceptability criterion more restrictive or not.

T=7 gg		T=10 gg		T=13 gg	
Panelist 1		**Panelist 1**		**Panelist 1**	
Lasagne	**Chicken**	**Lasagne**	**Chicken**	**Lasagne**	**Chicken**
The lasagna cooked in JARSTY seems slightly more acidic	Differences in flavor, odour, texture and state of conservation are not remarkeable	The lasagna cooked in JARSTY is more palatable; the one cooked in the common food keeper is drier and less pleasant	The chicken cooked in JARSTY is more palatable and much moisty compared to the one cooked in the common food keeper. No variation of colour and state of conservation were observed	Same colour and texture, but the food cooked in the JARSTY is more moisty, fragrant and tasty.	Same colour, the meat became stingy and the taste is not palatable in the food keeper. The chicken is much moisty and tasty if cooked in the JARSTY
Panelist 2		**Panelist 2**		**Panelist 2**	
Lasagne	**Chicken**	**Lasagne**	**Chicken**	**Lasagne**	**Chicken**
Differences in flavor, odour, texture and state of conservation are not remarkeable	The consistency is better in the chicken cooked in JARSTY: is much moisty and the flavour is more pleasant.	The consistency is better in the lasagna cooked in JARSTY: the flavour is more pleasant	The chicken in Jarsty is more palatable, has a better consistency and much moisty compared to the food keeper.	Same colour and consistency, but in the JARSTY the lasagna is much humid, fragrant and tasty.	Same colour, but the consistency and the flavour are not agreeable in the common food keeper, while for the chicken cooked in the JARSTY the flavour is much tasty and the moisture is higher.
Chief Panelist		**Chief Panelist**		**Chief Panelist**	
Lasagne	**Chicken**	**Lasagne**	**Chicken**	**Lasagne**	**Chicken**
The lasagna cooked in JARSTY seems slightly more acidic.	The chicken cooked in the standard food keeper is stingy and degraded.	The lasagna cooked in JARSTY is more palatable	The chicken cooked in the standard food keeper is less agreeable and degraded.	Same colour and consistency, but in the JARSTY the lasagna is much humid, fragrant and tasty.	Same colour, but the consistency and the flavour are not agreeable in the common food keeper, while for the chicken cooked in the JARSTY the flavour is much tasty and the moisture is higher.

Microbiological tests

The microbiological tests, the results of which were reported in the tables, were performed at Accredia accredited partner laboratory No. 1020.

The results are often not assessable, sometimes they present negligible contamination, with some deviations which fall within the scope of variability due to measurement uncertainty.

Basically, the microbiological quality is great for all samples tested.

This is due to the cooking process, which involved special conditions and high temperatures.

The temperature recorded in food after opening it is in fact slightly less than 100° C, as shown in the image below.

It is therefore correct to speak of **pasteurization of food**; The temperatures recorded, since they relate to a process that took place partly under pressure and therefore under vacuum, involve an even more severe action on microbes compared to treatments performed in non-vacuum processes.

COMMENTS AND CONSIDERATIONS

In the present study, the shelf life was monitored and determined by the investigation of microbiological indicators (molds, yeasts, CBT, enterobacteria, coliforms, etc.), chemical indicators (appearance of degradation substances, loss of aromatic components) and organoleptic indicators.

The microbiological analyses performed in the present study have shown the same behavior between the JARSTY container under study and the traditional containers on the market. This is evidently due to the effectiveness of the cooking process that took place in the JARSTY container, which drastically lowered the microbiological levels of the dishes.

On the other hand, instrumental analyses of the aromatic profile, with the same food and storage conditions, show that the JARSTY container preserves the aromatic profile more than other packaging. This indicates that enzymatic degradations and oxidations are reduced thanks to the technology developed, and overall this factor can reasonably suggest that from the point of view of sensory acceptability the use of the JARSTY container is preferable to the use of other products on the market.

Participants in sensory tests, which involve the evaluation of smell, color, taste and texture, expressed their preference for products prepared and stored in the container JARSTY.

Il Direttore Tecnico

Marinella Vitulli

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